



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

OPENING ADDRESS *of the* PRESIDENT *of* SECTION F (ECONOMIC SCIENCE *and* STATISTICS) *of the* BRITISH ASSOCIATION *for the* ADVANCEMENT *of* SCIENCE, *at the* THIRTY-SECOND MEETING, *at* CAMBRIDGE, *in* October, 1862. *By* EDWIN CHADWICK, ESQ., C.B.

As it has become customary in this Section, as in others, for the gentleman who fills the office which I have the honour to hold at this meeting, to open the proceedings by stating some of the views which he may entertain on the progress of the sciences in which the members specially attached to this section are the most interested, I beg leave to solicit your attention to the observations which I now submit to you in conformity with that practice.

Besides statistical science, it has been our custom to treat of economical science in its widest and most popular sense, not confining it to economy in its political relations, but treating of economy in its domestic relations, comprising house-rule, as well as what have been called burgh-rule and state-rule. It has been our practice to look to the conclusions deducible from any set of facts which may come before us, without considering of their position under any system, or their conformity to any general scientific definition. It is useless to discuss the merits of this course, for it is the only one at present practicable. On this occasion, however, I solicit your attention to some elementary questions, progressive to the formation of wide scientific principles.

Amongst the foremost popular objections to economical science represented by popular writers are these: that it does not take into account human feelings and passions, or mental pains and pleasures;—that it seeks only material wealth, no matter how obtained, and at what expense of human suffering. This allegation I shall show to be a mis-statement; but I would observe, that it might as well be objected to physiology that it does not take into account external beauty of form or of colour, which are the main objects of cultivation by the sculptor or the painter, as it is to object to economical science that, regarding immediately the material and physical objects of production, and services conducive chiefly to physical well-being, it does not occupy itself with the spiritual, and the metaphysical, or with mental pains and disabilities, which are the province of the theologian and the moralist, as political rights are the province of the politician.

Our great word and historical scene painter, my friend Mr. Car-

lisle, designates political economy as the “dismal science.” As propounded by some of its professors, reasoners of the abstract and geometrical class, from assumed data, it certainly led to some large dismal conclusions, chiefly on the population question; but on closer and more recent examination, that is to say by the close scrutiny of particulars, by exhaustive collections of them, and wider inductions from them, it will be found that those conclusions are dissipated, and others of an opposite character, more in harmony with popular sentiments and instincts and with elevated views of human progress, are confidently indicated. Another popular writer, also an able word-painter and elevated cultivator of æsthetics, Mr. Ruskin, has lately rushed amidst the economists, and taken them to task for what he considers their short-comings, because they do not, amongst other things, treat of the “roots of honour,” or of “habits of gentleness” and justice,—assuming gratuitously that those qualities are not recognized and are disparaged because they are left to be cultivated and their opposites to be dealt with by the divine, the moralist, and the jurist,—who will be found to have plenty to do for their cultivation by separate divisions of labour. Mr. Ruskin cites a declaration in favour of Truth in commercial transactions by an old Hebrew merchant to whom a statue was raised in Venice, and he cites it as if it were new to the commercial and economical transactions of our times, and at variance with political economy, which he represents as “proclaiming vociferously for the law of the universe that a buyer’s function is to cheapen and a seller’s to cheat.”

Now, I had the pleasure of the acquaintance of perhaps the most wealthy and successful merchant of the last half-century, a member of our political economy club, the late Mr. James Morrison, who assured me that the leading principles to which he owed his success in life, and which he vindicated as sound elements of economical science, were: always to consult the interests of the consumer, and not, as is the common maxim, to buy cheap and sell dear, but to sell cheap as well as to buy cheap; it being to his interest to widen the area of consumption, and to sell quickly and to the many; the next maxim as involved in the first principle—always to tell the truth, to have no shams; a rule which he confessed he found it most difficult to get his common sellers to adhere to in its integrity, yet most important for success, it being to his interest as a merchant that any ship captain might come into his warehouse and fill his ship with goods of which he had no technical knowledge, but of which he well knew that only a small profit was charged upon a close ready-money purchasing price, and that go where he would he would find nothing cheaper; it being, moreover, to the merchant’s interest that his bill of prices should be everywhere received from experience as a truth, and trustworthy evidence so far of a fair market value.

I might cite extensive testimony of the like character to show that the very labour and risks of continued deceits, however common are detrimental to the successful operation of economic principles and that sound economy is everywhere concurrent with high public morality. We may, indeed, claim from professors of high art like Mr. Ruskin, that they have yet to take into account more of the economical than they are aware of, much of the economical being immersed in the physical and material in connection with the beautiful. I remember talking with him once on his search for works of art in Venice, on which he discourses so eloquently, and, describing to him my own feelings at the filth and squalor of the population, as suppressing any of admiration for art amidst the foul and pestilential. I remember his admission that in that city the seats of ancient art were commonly centres of filth, so much so that his attendant in his explorations would sniff an ill odour, and when it was strong would say, "now we are coming to something old and fine"—meaning in art. I would submit that the nose of the attendant gave a truer indication than the eye of the painter, for the right direction of labour, which must be for works of purification to produce the truly beautiful, which is always connected with the economical. To do him justice, however, I might claim the honour of having him as a disciple, even as an economist in this,—that he now recognises the laws of health and the exercises enjoined by them (which are the true foundations of the beautiful), as sources of national economy. I cite his pictorial expression of the conclusion, "That it may be discovered that the true veins of wealth are purple, and not in rock but in flesh; perhaps even that the final outcome and consumption of all wealth is in producing as many as possible of full-breathed, bright-eyed, and happy-hearted human creatures."

Adopting for myself this statement of the end of economical science, and adopting it not hypothetically but positively, yet as the artist for his purpose views the human being as a subject for the cultivation of the beautiful—as the physiologist for the cultivation of his art views him solely as a material organism, so the economist for the advancement of his science may well treat the human being simply as an investment of capital, in productive force. Taking this view and confining our consideration to the value of a human being simply as an investment of capital, I apprehend that that value, and the economical principles would be evolved by the inquiries necessary to determine the compensation due upon anyone killed by a railway accident. If it be a child, how much capital has been invested in it; that is to say, how much must it have cost to rear it? How much capital must be expended to rear one of the like? What were the chances of the duration of its life and working ability which are determinable by the

insurance table? What would be the future wages of a labourer of the class during that time? What are his possible savings upon those wages over and above absolute necessities of life?—the total of which would represent the value of the investment, for which compensation would be due, apart from the pains of the loss inflicted upon the survivors, apart, also, from what may be deemed the politico-economical value of the individual, the profit which is due to the capitalist for his labour and risk in finding work, and the payment for the capital advanced as wages.

Now, on the actual contract price in England of raising an orphan child, in a well administered public institution, the actual cost, in food, clothing, and labour, would not be less than 4*s.* 4*d.* per week. Its education and physical training would be about 4*d.* a-week more, making a total of 12*l.* 2*s.* 6*d.* per annum. At 11 years of age, when the child can generally earn its own food and clothing, it may be taken as an investment of 130*l.*, or the value, say, of a team of four first-class farm horses, or of a hunter; or at 21 years of age it would be an investment of about 250*l.*, or about as much as two hunters. Economically he may be viewed as an amount of available productive power. But in the existing insanitary condition of towns and of habitations, the expenditure in raising the one individual does not represent the whole cost of raising that power. In towns in a low sanitary condition, large masses of children are born only to die before the attainment of their maturity. Dr. Farr will support me in showing that in such towns as Manchester, Glasgow, and Liverpool, one-half the children born are in their graves before their fifth year, and much more than one-half by their twentieth year. The expense of the productive force of one adult worker is under such conditions that of rearing two children for each worker obtained. The domestic and political economy of these conditions is much the same as the agricultural (or hunting) economy would be, if to obtain one working horse two colts had to be reared. The investment on the young artisan, at the end of his apprenticeship, may under these conditions of waste be regarded as equivalent to that in three hunters.

But for how long will that investment continue to be productive? The unproductive investment in early childhood must be distributed over the whole period of his working ability. If the duration of that ability be short, the annual instalment of capital in rearing, to be wiped off by an annual instalment of repayment, must be heavy; if the duration of the working ability be long, it will be light. To the general population of Manchester it would be about twenty-eight years, to the artisan class especially it would be twenty-five years, whilst in less unfavourable sanitary conditions, taking one in the same county, Ulverstone for example, it would be forty years.

Now, it would be of great importance to a man of the wages class

(as well as to most of us) if he could be got to consider himself as an investment, and how much capital there is in him, and of the relation of his own labour to his own capital, and how it may be economised. When the truths of economic science gleam upon his mind, as it may be expected to do with the progress of public information; when he is made aware, amongst other things for the economy of that capital, that the cheapest tenements are often the dearest to inhabit; that to settle in a badly administered city, to live in an ill-conditioned house, where he has no proper water supply or means of cleanliness, or to work in a badly ventilated shop, will, in the long run, subject him and his family to double the amount of expensive sickness that he would incur in a rural or a better conditioned district; will subject him to the loss of ten or twelve years of the duration of working ability; will at the lowest estimate subject him to an aggregate loss of 200% of the value of his labour; will deprive him, in all probability, of the means of acquiring the last consolation of old age—easy and respectable independence, and rest upon his savings from labour—then he may be expected to resist the temptations from increased wages to settle in such place, or to insist upon conditions suitable to his labour, or the due economy of his investment; then we may expect that under the pressure of economic elements, the attention of manufacturers will be directed to the economic conditions of work; then it will be that owners of inferior tenements, and landlords who are corporations, will be made aware of the coincidence of interest with duty, that their rents are better paid when there are fewer visitations of excessive sickness and premature mortality amongst their tenants; then may be yielded to economic principles that action for which appeals have been made in vain to the moral sentiments.

The annual excess of preventible deaths beyond an imperfect standard, in the county of Lancaster, is upwards of ten thousand adults per annum, who lose each more than ten years of working ability; the cost of the lost labour cannot be estimated at less than between three and four millions per annum; of the excess in sickness, nearly 400,000*l.* per annum; of the excessive funerals, upwards of 70,000*l.* per annum; of the whole county, upwards of four millions per annum. The data for this estimate were checked by Dr. Lyon Playfair, and were given in his report to the Health of Towns Commission, and have not been controverted. In my report of 1842 on the sanitary condition of the labouring population, as displaying the effect of the overcrowding, or the bad ventilation of places of work, I showed that when the workpeople were discharged from them in periods of distress, fever, instead of increasing, as was once the hypothesis, diminished, and fever wards were almost emptied, the people living upon simple food being in search of work abroad in the less

impure air of the streets. In accordance with the observations which I then made, in the present seats of the most intense manufacturing distress, the average sickness and mortality, instead of being increased, has, it has been noted with great surprise, diminished. The very town where we were assembled (Cambridge) may be cited as an example, though in a lower degree, of the waste of capital to an extent of upwards of 20,000*l.* per annum under the same heads; to the extent, as I would inform the townspeople, of not less than 20,000*l.* per annum as compared with the rate of sickness and mortality prevalent in the district of Linton and Newmarket, a loss due to the neglect of such sanitary measures as have been taken in the neighbouring city of Ely, in the newly and properly drained portions of which the death-rate has been reduced nearly one-third, and that too by measures which leave much to do, but which yet give the inhabitants, as it were, a jubilee every third year in which there are no cases of sickness and no deaths.

The annual waste of capital in England and Wales, from the loss of labour, from excessive sickness and premature mortality, I estimate at the very least at between fourteen and fifteen millions per annum.

As illustrative of the economy of prevention, I cite the following from a paper which I submitted to Lord Palmerston, in 1856, previously to the issue of the army sanitary commission, and which I refer to now, because the reduction then spoken of as an instalment has subsequently, and by as yet partial measures, been practically accomplished. I submit it as applicable in principle of economy to the labouring population. "The expense of every "trained soldier—and the greater proportion of the deaths appears "usually to occur after the period of training has been completed—"is usually stated at 100*l.* to 120*l.* per man; ten lives per 1,000 of "mean force saved will save the public 1,000*l.* per annum. The "reduction of the non-effective period of service, by the reduction of "the average period of sickness from fifteen days to six or to five, "the reduction of the numbers constantly in the hospital from an "average of forty-six to fifteen, will be equivalent to an increase "of the effective force by 30 per 1,000 of mean force, or a saving of "expense proportionate to the numbers of the men to the expenses "of the whole regiment; the total sum which may be saved by sanitary measures would be equal to between 1,000*l.* and 2,000*l.* per annum per 1,000 of mean force at home or in the colonies. This, "capitalized at 5*l.* per cent., would, were it needed, justify an expenditure of 30,000*l.* or 40,000*l.* per 1,000 of mean force for effectual "measures of prevention." The saving by sanitary measures, as reported by the Secretary of War, is now equal to a brigade of mean force annually.

There has been a reduction of deaths from the zymotic, the fer-

menting, or foul air diseases, to less than one-quarter; of the tubercular diseases to less than one-half; of the mortality of the line, from 17·9 to 8·36 per 1,000. Here is a brief statistical display of what has been done,—made by Miss Nightingale, to whose labours, with Lord Herbert, in this special branch of sanitary service the results are pre-eminently due.

	Deaths Annually to 1,000 Living.			
	Zymotic.	Chest and Tubercular Diseases.	All other Diseases.	All Causes.
English male population, aged } 15—45, 1848—54	2·0	4·5	3·3	9·8
Infantry of line serving at } home, 1837—46	4·1	10·1	3·7	17·9
Infantry of line serving at } home, 1859—60—61	0·96	4·2	3·4	8·56

Now, each head of the reduction of disease may be treated by the economist as a reduction of expense—a staying of waste. The standard of comparison, the death-rate prevalent amongst the ordinary population, I aver, is in excess full one-half beyond what is obtainable, by means which are so certain, that their attainment and maintenance may safely be made matter of contract as for the preservation of investments. We give these facts in aid of the divine and the moralist. Every unit of such statistical figures as those cited, involves a case of pain in the being whose power has been stricken down, of mental suffering in survivors, and of diminished estimation of life on the parts of those who witnessed it going on to the end, which the orator and the man of feeling, may well pourtray; and let him do his separate duty by coming forward and pourtraying it, and exhorting governors and the representatives to their duties of not letting ill alone, of not giving the representations of evil the go-by, —of not for the sake of selfish ease, violating their moral duties to investigate and forward the means of prevention. Meanwhile, the economic administrator and the legislator, whose qualification it is pre-eminently to be an economist, should strive at his great task, which is, to unite interest—personal and pecuniary interest—in support of that duty, which it is the separate business of the moralist, and the right exercise of the pulpit to preach. Where that union can be effected its operation is most potent and complete.

I have not time, nor would this be the occasion for the development of that problem. I will only give an illustrative example of that union. At the commencement of the system of transportation

there was a severe mortality amongst the convicts. At first, instances occurred of as many as one-half being thrown overboard during the passage. Humanity was appealed to in vain, and the sufferings and loss were held to in the natural and unavoidable order of things until the economic principle was applied of contracting for results. Instead of contracts being made for the numbers embarked, payment was contracted for only for each person landed alive. This opened the eyes of shippers to the advantages of practical applications of sanitary science, and they engaged medical men and gave them means, and gave them, too, an interest in its instrumentary applications. The result was a reduction of the sickness and mortality amongst persons of bad lives to about $1\frac{1}{2}$ per cent. I took some pains to get the principle applied to the protection of pauper emigrants, and with the like satisfactory result. In these cases economy beat sentiment and benevolence. It evoked unwonted care for the passengers, and secured to every poor man who died at least one sincere mourner. When the sentimentalist and the moralist fails, he will have as a last resource to call in the aid of the economist, who has in some instances proved the power of his art to draw iron tears from the cheeks of a city Plutus.

Within the limits of the duration in years, of the productive power of the investment in a labouring man, economical science has to estimate also the degrees of intensity of its application during hours of the day as well as during the days of the year. I have paid much attention to this topic, and collected accounts from the employers of labour in different countries. From these I am enabled to state that, in general, and with few and rare exceptions, the British labourer is during the working hours of the day the foremost in the world. Two English labourers or artisans are proved to be equal in productive power to three Danes, or three Norwegians, or three Swedes, or three Norman labourers, or three Germans. English miners in Germany and in Sweden, though paid much higher wages than the natives, do proportionately more work in less time. Why this should generally be so as against people of kindred races living under different political and social conditions, is a question which, as it would require much local investigation, I have not attempted to solve.

But the advantage as against other races is yet greater. Mr. Robert Rawlinson, our sanitary engineer, who had experience of the native workmen, artisans, and labourers in the Crimea and in Turkey, assures me that it would have been cheap to have exported English artisans at 5s. a-day, as against Croats even at 6d. a-day, and so with other classes of labourers. Mr. Hawkshaw, the president of the Civil Engineers, who is conducting extensive railway works in Russia, tells me that he derives no pecuniary advantage from the best of the

cheap serf labour there, whether common labourers or artisans. From India reports of engineers are similar in relation to the larger proportion of work. As against serf labour in Poland, a Polish nobleman informed me that he found that the labour of five serfs was about equal to that of two English agricultural labourers. A shipowner, who had ships repaired in almost every port in the world states that he has nowhere found the work done cheaper than by the dearer labour in the British ports. Mr. Ruskin talks of the power of wealth being "greater or less in direct proportion to the "poverty of the men over whom it is exercised." He talks of "masters "never allowing servants to be idle," "feeding them as poorly and "lodging them as ill as they will endure," and holds up this course as being in accordance with economic principle. If he would make inquiry of the most successful employers of labour—those whose pay is chiefly piecework, he would learn that they prefer those labourers who earn the most wages, who therefore are the least poor; and that they find these the most profitable to them—time of execution, as well as the convenience of the direction of the few skilled and trustworthy, instead of the many unskilled and less trustworthy being taken into account. Whatsoever may be the supposed interest of any employer in poor labour, he will find that he will not get the best results without the labourer having some interest in it and a power of obtaining it which are not given by abject poverty. In fact, the rationale is, as Mr. Whitworth expressed it to me in respect to his horses, of which he takes great care, that he could not afford to work his machines with a horse that cost less than thirty pounds, or that ate less than eighteen pounds weight of oats a day.

But taking the general fact to be as I have stated it—that the productive power of two British labourers is equal to that of any three on the Continent, it is important that the economical principle involved in that fact should be understood and appreciated. In the economical aspect in which I am considering labourers simply as investments, as capitals—inasmuch as by better direction two capitals are made as productive as three—as one capital is thereby saved, that is to say, the expense of the required systematic training, of the food, the clothing and the lodging, which make up the third capital; this third saved capital may be, and the bulk of it is, actually divided between the other two, in the shape of extra wages, with some extra profit to the capitalist. This third capital saved is, I conceive, the source of the animal food, the drink, and the extra stimuli, in which our labourers indulge beyond those on the Continent, which amount, according to my reckoning, to upwards of seventy millions annually, or one-third the estimated wage-fund of Great Britain. But if two capitals or two labourers are equal to three, two populations, speaking roundly, are economically equal to

three, and it may be confidently asserted that the twenty-seven millions of population of Britain are from this very cause, in economical force at least, equal to the thirty-seven millions of the population of France.

Individuals and nations have yet, as it appears to me, to be instructed by economical science on the waste of capital, not only from, misapplication during available hours, but during available days of working ability. Mr. Moses Engel, the Hebrew principal of a school for teaching the children of Jews, in speaking of the inability of parents of that community to pay for the education of their children, thus indicates the economical grounds why the Jews must, as a people relatively to such a people as the English or the North American, be always a poor people, and a badly educated people too, ignorant as well as poor. "Jews, by their religious and social distinction, are "exceptionally placed in regard to business; their religious scruples "compel them to abstain from labour on Friday evenings, Sabbaths "and festivals—say about one-fifth of the year; their respect for social "laws induces them to refrain from their occupations on Sunday. "Thus they lose about one-third of the year. Hence few Christian "masters will take Jewish apprentices, and the circle of Jewish trades "is contracted, because of a Jew's inability to compete against men "whose hours of work are so many more than his own. Hence, too, "the Jewish artisan or tradesman earns less than the Christian "artisan or tradesman; and hence arises a greater necessity for the "earnings of children; thus, Jewish children are often withdrawn from "school at nine or ten years of age; and even while supposed to be "on the school books, they are so often kept at home to assist at some "domestic or industrial labour, that they benefit but little by "education."

In France, according to Vauban, it was necessary in his time, and I am informed that in the greater part of that country it is so still, to take from the working period of the year, besides the 52 Sundays, 38 fête days, 50 days of frost, 25 days of inability from sickness, 20 days for fairs, markets, and family affairs, leaving the French workman a total of only 185 working days to his year. In some parts 62 days are put down as feast-days, and 41 days for bad weather. In Prussia there are stated to be only 220 working days to the year. In the course of some inquiries in relation to the condition of the lower classes of the population in Ireland, I was informed that there was scarcely a cottier who did not attend a market once a-week, though he had nothing to sell, nor failed to attend the monthly fairs whether he had any business there or not, nor missed attendance at any one of the funerals of persons of his class or connection, and that their wakes and funerals would consume between twenty and thirty days in the year; and that moreover he religiously

observed all the saints' days, and that these deductions made more than 100 days in the year, thus bringing the sum of the working days under bad sanitary conditions and idleness, below those of the peasantry in France, or to less than two-thirds of the working days of the English labourer.

But it may be asked of these populations, are they not, with the greater freedom from toil, less early worn out than the English labourers? Statistics answer—No. They are sooner worn out. In France as well as in Ireland the general average duration of life is lower than amongst the classes in England, and so far as I am enabled to ascertain as to the duration of peasant life, and of the agricultural classes generally, it is much lower than in England, where there is yet wide room for improvement. In those countries there is then a greater expenditure of capital to obtain a less amount of production. Viewing the labourer individually, economically, as an investment, his waste, is chiefly in the misapplication of the hours of his days, commonly to the extent of one-half the productive power; then in the misapplication of the days of his years, to the extent of not less than one-third, and in the loss of productive years of his life, to the extent of at least another third by premature disability and mortality, and that too, I repeat, as compared with a positively inferior standard. Add these economical results together, of which politicians take no notice, and I apprehend that they will of themselves make a real condition of the people question, and will account for the wretchedness of populations, independently of any conditions of political privilege to which it is common to ascribe them. I might, if there were time, present from recent accounts examples of these economical defaults, in the reported condition of the Sicilian and other Italian populations.

In England there is, I believe, on the other hand, much waste of capital as working power, by overwork, chiefly in the duration of the working hours of the day, most certainly so in relation to the labour of children, who, too, in school-time are subjected to over-mental and under-bodily work, and in the workshop to over-bodily work. When engaged under the commission of inquiry into the labour of young persons in factories, my colleague, Mr. Thomas Tooke, agreed with me in the adoption of the conclusion from the evidence, that the interference of the State was requisite to prevent the young and future working stock of the country from injury by overwork, as well as by exclusion from education by reason of overwork. We found children and young persons kept at work during the same stages as adults, which, on physiological grounds, we pronounced everywhere to be overwork and wasteful, just as it is everywhere overwork and wasteful to work a young and growing colt with and during the entire stage with a full-grown horse. We did not fail to

represent the sufferings of the children, as well as the economical grounds for legislative interference; but we were opposed on an assumed economical position, that the amount of produce from machinery was as the hours of work, however long, as was also alleged the reduction of the establishment charges on the machinery to the extent of its continuous hourly use; and it was alleged therefrom that the reduction of the hours of the children would practically occasion a corresponding reduction of the working time of the adults, and would hence incur a loss of capital.

We met this plea by a provision for working children in double sets of half-day working time. We relied most confidently on the fact of the injury done to the children, and the waste thence arising, as grounds for interference. But our measure for interference, which was resisted on assumed economical grounds, was carried chiefly on sentimental impressions. We were prepared, nevertheless, to prove that the assumed economical ground, as to the production from machinery being as the duration of the working hours, was fallacious. We could have proved that the produce, even from the machinery called especially "self-acting," was largely dependent on attention,—on mental as well as manual labour,—that mental labour cannot be indefinitely prolonged productively; that beyond certain limits, even with the stimulus of piece-work, the labour with the so-called self-acting machines cannot be prolonged productively, as the amount of spoiled work increases and the work turned off diminishes.

Experience of these economical principles, as applied to labour in factories, has fully established them, for, from the improved attention during the reduced hours, and the better sustained labour in the reduced hours, the former amount of production has, on the whole, been maintained. Lancashire, with restricted child labour and short hours, now fears no competition with the unregulated labour of Austria, with its so-called cheap labour and long hours, of fourteen or fifteen hours a-day. Foreign manufacturing capitalists in Alsace and the Tyrol, have declared to me that if they had capital to invest *de novo* in manufactures, they would prefer to invest in Manchester. The protection of children's labour in the growing stage has decidedly arrested grievous physical deterioration and waste, and there are fewer deformed and maimed young persons there of the rising generation. Manufacturers who were formerly opposed to the principles of the Factory Act, now urge its general extension to agricultural as well as to mining and all other labour. I am not particularly informed on the early closing movement, but I have been assured, in respect to some branches of trade, that the reduced hours of business have led to improved methods and habits on the part of the public, so that quite as much is done as before during the longer hours.

Our overwork in England would appear to be chiefly in the hours of the working days. The appointed seventh day of rest appears to be above any economical question. Longer intervals would be insufficient; shorter, if the six days are moderately occupied, were unnecessary. At the Dublin meeting of this Section, Mr. Bianconi, the great post-horse contractor, was complimented on religious grounds for the rule he adopted to give all his horses rest on the seventh day; but he frankly disclaimed the religious motives ascribed to him, and declared that he adopted the rule because he found that by the seventh day's rest he made 11 per cent. by the improved working power and value of his horse stock. I believe that an economic reward is attendant on obedience to the command in respect to the human stock.

The most correct adjustment of human force for the most productive application, as an investment, would require considerable observation of varied sanitary and other conditions over long periods of time. Amongst the means of sustaining that force, would be what may be termed the metaphysical means;—pleasurable mental excitement accompanying the work, or in the results. On physical means alone, as food, clothing, housing, however good the work after a time often goes on heavily; wearily slowly, and it requires mental stimuli to sustain the bodily energy. Thus a band, when a march flags, gives relief and force. I was once present at a discussion between two engineers, who had large bodies of navvies and artisans camped out for work in isolated districts, as to the results and comparative economic value of their respective methods of providing mental relief and stimuli to work; the one had hired musicians and dancers, the other scripture readers and animating or sensation preachers,—each method being treated with perfect indifference as to choice, except as a means of productive force and profit on capital in the work done. In weaving shops and in places of semi-automatic work, it is I am informed becoming customary to employ readers to read novels, works of imagination and histories, and matters of stirring interest, which is found to give to the hand, somewhat of the life energy and regularity of movement, which the band gives to the march. Hence the “dismal science,” to use Mr. Carlyle's phrase, may find a place for him, and for imaginative writers, like our friends Mr. Dickens, Mr. Thackeray, and Mr. Ruskin, rivals to bandsmen as suppliers of stimuli to force,—enlivenment to work, and of aid, which they may not have intended,—to capital and production.

Amongst the means to sustain force, are some physical means of which physiology gives information. It may be set down as an economic axiom, that whatsoever else they denote,—filth and squalor in a class or population, denote loss of power and waste, and amongst

other things, an immediate waste of food to produce a given amount of force. A friend of mine, a general, who was beleaguered with a battalion, in Spain, had his men put upon short rations. To occupy and amuse them, he sent them to a neighbouring river to bathe daily, and he found what he had not expected, that under this course of daily ablution, his men were in better force, that his power was greater, on their short rations, than other men were on their full rations. It is beginning to be found out that cleanliness is profitable for farming stock. Experiments are related of the comparative growth of pigs, unwashed and uncleansed, as compared with pigs of which the skins are washed and fed on the same sorts and quantities of food, and the growth of the washed was nearly one-fifth greater than of the unwashed, and in other instances the gain from cleanliness was greater, and so with horses. Amongst soldiers of the line who have only hands and face washing provided for and the death-rate is upwards of 17 per 1,000. When sent into prisons where there is a far lower diet, sometimes exclusively vegetable, and without beer or spirits, but where regular head to foot ablution, and cleanliness of clothes as well as of person is enforced, and there their health is vastly increased, and the death-rate is reduced to $2\frac{1}{2}$ per 1,000. I believe that a large proportion of the superior health obtained in prisons on very low diets, some of them costing not more than fifteen or eighteen pence per head per week, is to be ascribed to the complete personal purification enforced. Instances have come under my observation in schools and public institutions, where on ventilation and pure air being introduced, there has been a reduction of the sickness and death-rate by one-third, and on the introduction and daily enforcement of regular daily ablution, there has been a reduction of the sickness and death-rate by nearly another third, the food being unchanged. I believe that a large proportion of the greater duration of life amongst the higher classes, is due simply to superior personal cleanliness. I am confident that I shall be justified in stating, that beyond any saving in the power of food, that the practice of complete personal cleanliness, would be found to be a great economy, and that the regular daily head to foot ablution and purification of the person would alone add, at least one-fifth to the duration of the economic force of the population. Economic science, consulting sanitary science, would thus achieve, Mr. Ruskin's aspiration, of which the success would be visibly denoted, by a well-formed and rosy-cheeked, as well as "full-breathed, bright-eyed, and happy-hearted population."

As an important part of this topic, considering the child and the man as an investment, I am anxious at this time to direct attention to the economic elements involved in popular elementary education. Hitherto popular education has been advocated, and rightly, on

religious and moral grounds. I wish to point out the support that economic science may give to them.

Considering a child to be for our economical purposes an investment, the elementary training and education are necessary, to increase the efficiency and productiveness of the capital employed. I have been at much pains on this point to ascertain from employers the comparative efficiency and value of educated and uneducated labourers, and I find one conclusion unanimously agreed to on the subject by all intelligent witnesses of wide experience and observation ;—that education even in its present rude and in many respects objectionable elementary condition, is highly remunerative. Employers who have been at the expense of schools on high religious and social grounds, concur in saying that success is great on the lower economical grounds. In agriculture, intelligent workmasters are aware of the wide difference in result and value, between educated and uneducated, intelligent and unintelligent, labour, in the old and ordinary processes. But the expense of ignorance is the greatest in the obstructions which it presents to the introduction of machines, by which wages are augmented, whilst labour is saved. Where-soever machinery is introduced, increased education and intelligence is proved to be necessary to the production of its best effect. I have been assured by experienced mechanicians, that notwithstanding the progress of machinery in agriculture, there is probably as much sound, practical labour-saving invention and machinery unused, as there is used, and that it is unused solely in consequence of the ignorance and incompetency of the workpeople. In manufactures, the deplorable deaths and losses which occur in the application of steam-power, have been long ascribed, by Mr. William Fairburn, to the want of suitable education on the part of workpeople, to render them competent for its safe—and most economical direction. Out of an average of about eleven thousand deaths, annually registered in England and Wales as from “violence,” between five and six thousand are set down by our colleague, Dr. Farr, as arising in connection with the use of machinery and steam-power. When the cases are inquired into, it is apparent that the greater proportion of them have been occasioned by ignorance and recklessness. Railway managers complain in respect to the frightful accidents occurring, of the stupidity of their agents and labourers as the cause, and of the extreme difficulty of getting those who have little to do, to do that little well. We may judge of the importance to our prosperity, of the efficient direction of labour-saving power, by the fact, that every nominal horse-power is equal to the saving of the manual labour of about seven men. The four hundred thousand hands in the cotton factories have, according to the last returns, the aid of two hundred and seventy thousand horse-power, which is equal to the manual

labour of a population of nineteen hundred thousand labourers, but by working, as may safely be done under competent direction, at high-pressure, the nominal horse-power may be doubled and trebled. This is often done, but not under the intelligent direction required, and hence frequent terrible disasters. One intelligent stoker will work the same engine with from one-third to one-half the amount of coal that another will consume; one will nearly prevent all smoke, whilst another will consume more coal and keep the neighbourhood under a cloud of smoke and filth with the same apparatus. The great mass of smoke which beclouds manufacturing towns betokens ignorance and waste. Those who talk of the dangers of over education, are grossly ill informed, and are themselves so far under educated. But we may find important evidence of the value of education, where it has heretofore been deemed by members of the legislature to be the least necessary, where it has been supposed that mere machines are required, namely in the naval and the military source of employ. Naval officers attest the fact of the greater efficiency of educated as compared with uneducated seamen, chiefly in this, that the intelligent educated seamen, require less expensive superintendence by officers, and that fewer men can be trusted for acting together. Some officers say they would work a ship with a fifth less; others with a fourth less; others with a third less of the more educated, as compared with uneducated seamen. In the army, officers, more especially the superior non-commissioned officers, who come into the closest contact with the privates, give similar testimony. Sir John Burgoyne, maintains that the sapper, who is an artisan, with some education, is, for the ordinary purposes of war, equal to three common linesmen, and is economical at his additional pay. In the new school at Hythe, as well as at the school for naval gunnery, the success in shooting is with classes almost as the education of those classes. The effect of the general extension of elementary education, even in its present condition, would be to bring up the whole of the ranks to the efficiency of those of them who have the best common elementary education, even such as that is,—the non-commissioned officers, and it would be amongst civilians to bring up the entire body of them to at least the efficiency of the better educated of themselves,—the foremen. Let any one who has been in a position of civil or military command, and who knows those sound, trustworthy, and most excellent classes, the non-commissioned officers and foremen, estimate what that economical advance would be—a manufactory of foremen as working men,—a regiment of non-commissioned officers as privates. Amongst the economical elements of sound education, are the saving of the labour and expense of commands, and of superintendence,—saving of waste from untrustworthiness,—from blundering, from wantonness, and the misdirection

of force to the object in view;—saving the waste of time in learning new occupations, or new processes—a most important quality in our changing conditions of labour markets, as we may now see on a large scale in the north. A policeman who is an educated man (as also a volunteer), learns the military drill in weeks, against the months occupied by the uneducated labourer; and so with other changes of the application of capital or productive force.

With all this gain, however, from the better education as now conducted, I have impeached it for waste before competent educationists, before Lord Brougham, and before French, and Austrian, and other education commissioners sent over to this country to examine our elementary education. I have challenged it for waste and grievous injury—bodily done by over sedentary constraint to double the extent of time at which the same amount of instruction is, under the half-school-time system, imparted;—for waste by the injury done by exclusion from necessary exercise, and exclusion from productive occupation or necessary practice towards it, during half-days, or on alternate days, from the tenth to the thirteenth year. On a great mass of evidence Lord Brougham has declared the impeachment to be well founded; or, perhaps I might put it less objectionably, that the possibility of considerable elementary improvement proved. M. Rapet, the inspector of elementary schools in France, and one of the most laborious and successful practical educationists in Europe, has expressed to me his concurrence with the English witnesses, that all the elementary book instruction which children of the ages for primary school are competent to receive, may be given in about three hours daily, if those hours be well employed. Mr. Edward Duquetiaux, the inspector of the reformatory and industrial schools in Belgium, on the experience of those same schools, where the mental labour is little more than two hours a-day, and the attainments of the children quite equal to those of the long-time schools, expresses a similar conviction, and that the present long school-hours are a cruelty as well as a waste; and I anticipate that the conclusions of other foreign education commissioners, who have examined some of the boarding half-time schools in England, will be similar. I propose to substitute, for the excess of sedentary occupation, physical training, including the military drill; and I find that that drill may be imparted to a hundred individuals in the infantile and juvenile stages, at the expense of keeping and imparting the drill to a single recruit in the adult stage. If from every hundred children so drilled in early life, the Government obtain only two or three recruits, it will be amply remunerated for the expenditure in the physical training of the hundred.

But on the practical testimony of such men as the distinguished members of this association, large employers of labour, Mr. W. Fair-

burn and Mr. Whitworth, it is established that for all ordinary civil labour, four partially trained or drilled men are as efficient as five who are undrilled. In other words, considering the child as an investment, for a trifling expense of about one pound per head, the productive power of that investment may, by physical training, be augmented by one-fifth for the whole period of working ability. Professor Laisne, an eminent professor of gymnastics in France, says that I understate the gain of power when I state it at one-fifth;—and that, by early and complete physical training, speaking on his experience of a French population, it is practicable to impart to three the working power of five. Taking it, however, at one-fifth, which I believe is an under-statement, a gain of one-fifth, upon our previous gain of one-third of the producing power of our population, as compared with continental nations of which I have spoken, is a gain upon that of the productive power of a fifth more of population, say of about two Scotlands or of two Lancashires, without the expense of educating them, feeding, clothing, housing, and administering their public affairs. Economically it is equivalent to an addition of one-fifth of the wage fund of the country, which Mr. Newmarch, with others, estimates at two hundred millions per annum. If it be examined properly in the several primary economical aspects, the refusal of any sum of money which has been talked of by Mr. Horace Mann or others, as requisite for the attainment of a complete education at the public expense, the withholding it will be found to be of the lowest financial imbecility and the wildest waste;—an economy which cannot sacrifice one for a sure gain of ten! But in my view no additional grants are needed, only a better administration of the existing expenditure on education, by which a much larger population may be educated well than is now educated ill, and with extensive physical injury.

I would now offer exemplifications of the concurrence of economic principle in support of religious and moral principle in public education. Treating each child as an investment of capital to be applied productively in honest industry, it is a total loss if he fail from moral defaults. If he turn mendicant, pauper, or thief, he will still levy a maintenance on the public; as a thief most wastefully by spoil, as a criminal in prison or in convict establishments, he will be kept unproductively, generally at double the expense of maintaining a pauper. The insurance table would give him, from the tenth year, the chances of forty years of life and waste, and this waste would be under-estimated at the keep of a pauper, or a total loss of 480*l.* on every case of failure. As a matter of fact coming within my own personal investigations under the Poor Law Commission of Inquiry, not above one-third of the children reared in the old parish workhouses with adult paupers, after leaving the workhouses, could be

traced into respectable service in self-supporting conditions, and where the old educational conditions are permitted to continue, there is a total loss of two out of every three investments. By an increase of expenditure for an improved teaching power, by trained teachers in many of the unions, these losses have been considerably diminished, but in the schools for district of unions in which the children are kept free from the influence of adult paupers, where a higher order of educational power is employed, though at a reduced rate of expense—where there is physical training, with the military drill, and sometimes the naval drill,—there the moral features of able-bodied children, the failures to the extent of disqualification for respectable employment are reduced to within 2 per cent. ; to 2 per cent. of insurance charge upon the investment as against a previous rate of 60 per cent. of failures.

The case of the Royal Military Asylum, Chelsea, for the children of soldiers, which is a school of mixed physical and mental training, may be presented as another example of educational power and economy in result. In the investigation of the sources of juvenile delinquency or of mendicancy, and the parentage of the delinquents, one common answer was "Father a soldier" or "a sailor," "mother dead," or "mother unable to maintain him,"—"deserted;" and there cannot be a doubt that, in the absence of any care or provision for that class of children, the great mass of them must be economically total losses of capital. The following are the results of the returns of their characters from the commanding officers of the regiments which they have joined:—out of 376 children, 87 were returned as exemplary, 261 as good, 23 as indifferent, and only 5 as bad. But equally important is the evidence of the increased value given to the investments by good training, including the physical as well as the mental training, as displayed in the ranks attained by a large proportion of the children, and those ranks denoting the increased value which may be imparted to the investments by improved training. Twelve were staff sergeants, 25 sergeants, 32 corporals, 95 trumpeters or drummers, and 210 as privates. Out of this school seventeen had become commissioned officers. I attach much importance to schools of this description, as imparting with the physical training, those moral virtues, or speaking economically, those values implied in the term discipline, attention, prompt and exact obedience, patience, self-restraint, so important for productive applications. I am glad to find that his Royal Highness the Duke of Cambridge and the Council of Military Education are in advance in educational improvement, as they have ordered a reduction of the hours of sedentary application to an average of about three hours daily, and as the head master assured us on a recent visit with foreign commissioners, without any reduction of the

amount of mental attainment within the same periods in week or months.

Another school, the Naval School at Greenwich, I would cite as an example of the economical value of good teaching power, as proved by rare statistical evidence—for it is rare to get direct statistical evidence of the results of any particular course of education, or of education in general, as there is no systematic outlook on the career of the scholars and the results after they leave school. In respect of the civil district orphan schools, the results are ascertained by the inquiries of chaplains at their places of service. In the instances to which I have last referred, the results are ascertained by regular returns from the commanding officers. Some years ago, when the education given at the Naval School, at Greenwich, was on an ignorant notion of a low education and training being all that was requisite for a sailor;—then, there was great moral disorder, great waste, as shown by desertions. The statistics with which I have been favoured by the Reverend Mr. Fisher, the principal of the school, made up from the officers' returns for a series of years, and the school returns of intellectual progress, prove that the rise of intellectual improvement is accompanied by a closely corresponding rise in moral and also in economical result, by fewer or no desertions, by the advancement of the value of service obtained—as shown by the increased proportion of petty officers, and the appearance from amongst them of superior officers.

The general economical deduction from such evidence, is, that were the same methods of physical and mental training made general, as they might be, we should, in this special service as in the civil service, get equal or greater power with from one-fourth to one-third fewer men to enlist, feed, clothe, carry, and pension on retirement, which would be much longer deferred,—and consequently that we could afford to pay them better, and could better compete for voluntary enlistment with the civil service market. The progress of mechanical improvement in gunnery, with which it is the province of the mechanical section to deal with, as members of that section specially conversant with the topic agree, is to give greater power to fewer men, with higher aptitudes,—such aptitudes as sound physical and mental training alone will ensure. The tendency of those improvements is to give the battle to economic science, husbanding and wielding capital, with the aid of mechanical means, applied by skilled artisans, as engineers, under scientific commands. Educational statistics, such as those to which I have referred, demonstrate the practicability of completely abolishing the whole of that waste incurred by juvenile mendicancy and delinquency, and the great mass of habitual delinquency. So certain are the effects of the training and educational power as applied under the half-school time system,

that contracts might be made for the attainment of economical as well as moral results in these respects. Under existing circumstances, it is well to subscribe to reformatories as to hospitals for the treatment of the sick, but giving exclusive attention to them is like giving exclusive attention to the foundation and maintenance of hospitals for the alleviation of marsh and foul air diseases, without regard to the drainage of the marshes, or to the removal of the sources of the foul air whence the diseases arise.

The treatment of the stock of labour of the country as an investment, and of the chief conditions by which the productive application of that investment is diminished, or the capital wasted, would be incomplete, if we did not refer to the waste of the stock by excessive standing armies in time of peace, not to speak of wars. Armies have an economical value, as hedges necessary for the protection of production, but fields may be wastefully hedged to the injury of production. The conditions which withdrew upwards of 400,000 men from productive industry in France, 350,000 in Austria, 200,000 in Prussia, always in barrack or camp, and others in reserve, and a total of upwards of three millions of men as peace establishments in Europe, are conditions on which economists of all nations may be called upon to enlighten peoples. England has by her comparative economies in respect to military establishments, a store of power, from the consequent accumulation of capital, to get up military force when required to sustain war. In an economical point of view our volunteer movement is of great value, as supplying a better defensive force than old soldiers were inclined to admit, as diminishing the extent of need of a standing army, and as supplying this force without interfering with productive industry, and, indeed, in respect to large numbers engaged in sedentary occupations, favouring that industry, by giving the young the healthful exercise of which is requisite to the development and maintenance of their civil, productive, and economical power and aptitudes.

In many respects the volunteer movement is a sanitary as well as an economic movement. But does it not commend itself, as an economic measure, to make a general public provision for such military training, at those periods when all authorities acknowledge it to be most efficient, namely, the infantile and juvenile periods, the school periods, when it not only does not interfere with the productive industry of the nation, but is in itself a most necessary and powerful preparation for it? To the economists of France we may appeal for representations against the waste which prevails there, and justifies or provokes the like waste of the labour stock of surrounding nations. To them it may be pointed out for consideration, that one year's cost of each soldier would subsoil-drain five acres of land permanently, and would repay the cost in five years by

extra production; that one year's keep of every regiment would subsoil-drain more than two hundred and fifty miles of road, and serve as outfalls for the subsoil drainage of the adjacent fields, which require drainage through a large part of France. Their yield of wheat does not average more than from thirteen to fifteen bushels an acre, with all their advantages of soil and climate; ours in the corn-growing districts being double that. I would venture to propose to our gallant neighbours the complete conquest of the soil of France itself,—it being economically, a more glorious achievement to double the production on their own soil, than to double the area of their dominion by conquest, even if modern civilization allowed them to clear off existing owners and occupiers from the country conquered. The annual cost of the keep of two soldiers for a-year, would provide permanent works of water supply and drainage (including the substitution of water-closets for the pestilential cess-pools) for two houses,—would reduce the sickness and death-rate of the inmates by one-third. The expense of one year's keep of one-tenth of their army, or fifty thousand men, would render this permanent service to every house in Paris, and would annually save eight or ten thousand of the population of that metropolis from perishing by foul air diseases. So would the expense of two iron-clad steamers.

The Emperor has expressed strong wishes for the improvement of the sanitary condition of the population, but his wishes have not been properly seconded by executive officers or by the legislature. Forty per cent. of the population in France can neither read nor write, and are plunged in the darkest ignorance. The expense of keep of one soldier for one year would train and educate three children for life. The keep of one regiment of one thousand men for a-year, would serve as a foundation for the perpetual elementary physical and mental training of as many children. When we remember that upwards of three millions of men are withdrawn in the prime of life from productive industry, in Europe, at an annual direct charge of upwards of 2,600 millions of francs, as estimated by M. Block, or as estimated by the Baron Czernig at 816 millions of Austrian florins per annum, and when it is considered that the loss to productive industry must, as estimated, be an almost equivalent amount for the maintenance of mutually menacing forces, we may imagine from such dreadful waste, the vast gain to be derived from the prevalence of principles of economic science amongst peoples, and thence in governments.

The appointed time only enables me develop incompletely the rudimentary principles of economy which my investigations have led me to consider applicable to the labourer, treating him, as I promised, as an investment of capital. I shall have done something if I have

increased the conception of the value of the material which we possess as compared with other nations, and drawn attention to the conditions by which the productive power of that material and great source of national wealth is impaired, viz.,—the conditions unfavourable to his growth,—to his health,—to the amount and duration of his force—to the waste of his power, from want of education and from misdirection, and from want of intelligent aptitudes—to the waste from over bodily work and under mental work, as well as from over mental work and under bodily work in the school period. These conditions may be modified or extended as economical conditions, but it will not be by meditations or abstract reasonings in the closet, but by direct observation in the field or in the workshop, by collecting the experience of leaders of industry, such as Mr. Whitworth and Mr. Fairbairn in the mechanical section; by collecting in Section D the observations of Professor Owen, and the other professors of physiology, which has an intimate connexion with economical science, in dealing with its source of force for production. Having made collections of facts from those sources, economic science and statistics will weigh, and enumerate, and give a money account of them. To those reverend professors and members of this Hall and University, by whose attendance we are honoured, I should have been glad to have submitted more fully the amount of aid they will derive from the concurrence of sound economic science, as developed by independent investigation, with those elementary principles of morals and religion which it is their province to maintain and advance. I might have shown at greater length, that indolence and filth and squalor always involve sin as well as waste, and that sin always involves economic waste; that the moral elements are always involved inextricably in the material the physical and the economical, and cannot be long advanced independently of them;—that, whilst for the purpose of investigation, it may be convenient to treat the economic apart from the moral elements, they must for the purpose of public instruction and most successful application, be regarded and treated in combination.
